

**RIDGE ORIENTATIONS OF THE RIDGE-FORMING UNIT, SINUS MERIDIANI, MARS—A FLUVIAL EXPLANATION.** M. Justin Wilkinson<sup>1</sup>, and A. Herridge<sup>2</sup>, <sup>1</sup>Jacobs Technology Inc., 2224 Bay Area Blvd., Houston, TX 77058, [justin.wilkinson-1@nasa.gov](mailto:justin.wilkinson-1@nasa.gov), <sup>2</sup>School of Science & Computer Engineering, University of Houston—Clear Lake, 2700 Bay Area Blvd., Houston, TX 77058, [adherridge@outlook.com](mailto:adherridge@outlook.com).

**Introduction:** Imagery and MOLA data were used in an analysis of the ridge-forming rock unit (RFU) exposed in Sinus Meridiani (SM). This unit shows parallels at different scales with fluvial sedimentary bodies. We propose the terrestrial megafan as the prime analog for the RFU, and likely for other members of the layered units. Megafans are partial cones of fluvial sediment, with radii up to hundreds of km. Although recent reviews of hypotheses for the RFU units exclude fluvial hypotheses [1], inverted ridges in the deserts of Oman have been suggested as putative analogs for some ridges [2], apparently without appreciating the wider context in which these ridges have formed is a series of megafans [3], a relatively unappreciated geomorphic feature.

It has been argued that these units conform to the megafan model at the regional, subregional and local scales [4]. At the regional scale suites of terrestrial megafans are known to cover large areas at the foot of uplands on all continents—a close parallel with the setting of the Meridiani sediments at the foot of the southern uplands of Mars, with its incised fluvial systems leading down the regional NW slope [2, 3] towards the sedimentary units. At the subregional scale the layering and internal discontinuities of the Meridiani rocks are consistent, *inter alia*, with stacked fluvial units [4]. Although poorly recognized as such, the prime geomorphic environment in which stream channel networks cover large areas, without intervening hillslopes, is the megafan [see e.g. 4]. Single megafans can reach 200,000 km<sup>2</sup> [5]. Megafans thus supply an analog for areas where channel-like ridges (as a palimpsest of a prior landscape) cover the intercrater plains of Meridiani [6].

At the local, or river-reach scale, the numerous, sinuous features of the RFU are suggestive of fluvial channels. Cross-cutting relationships, a common feature of channels on terrestrial megafans, are ubiquitous. Desert megafans show cemented paleo-channels as inverted topography [4] with all these characteristics.

**Method:** Analysis of the ridged unit has been bedeviled by the complexity of the ridge patterns. One approach is to examine those ridge networks which do not portray apparent impact crater-related morphologies. To test the hypothesis that parts of the ridge networks are *fluvially* formed, we examined ridge patterns specifically in areas in which crater control of ridge pattern appears to be low or absent. Although most areas of SM are more or less heavily affected by buried, partly buried and younger crater forms, several

intercrater zones in which crater influence appears low, were identified. Attempts in these preferred areas were made to exclude all linear features and ridges with a single radius of curvature (rather than sinuous with two radii of curvature) as being possibly controlled by crater rims. Linear ridges that could be interpreted as radial dykes or ejecta features were also excluded. Ridge patterns with strong preferred orientations suggesting conjugate fractures were also excluded. Otherwise we have taken sinuosity as a key criterion for fluvial features, represented by variable and usually opposed radii of curvature.

Lines joining ridge start and end points were used to represent the length and azimuth of measured ridges.

Five student groups were employed as separate operator groups to reduce bias in data collection.

**Results and Discussion:** One hundred ninety-six azimuth data points from three “crater-free” areas of SM were collected. These were binned in six 20° bins representing a semicircle of possible azimuths. The mean azimuth was 354°, which closely corresponds to that attained for a region-wide northwesterly dip, based on measurements of 14 stratigraphic horizons in the SM layered suite [1]. Together with the basin-scale and sub-basin-scale evidence, this result adds weight to the interpretation of the RFU as a fluvially emplaced unit since the mean azimuth of megafan river orientations will accord with the regional slope.

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